Polynomial Regression model

x	x
7·6	157
7·1	174

Step-1 Read, $n = 0.1$ epochs $= 1, m_1 = 1, m_2 = 1, c = 1$

Step 2: iter = 1

Step 3: sample i = 1

Step 4: $y_p^i = m_2 (x_i)^2 + m_1 x_i + c$

$$y_p^i = (1)(7·6)^2 + (1)(7·6) - 1 = 64·36$$

Step 5: $z = \frac{1}{2}(y_i - y_i^p)^2$

$$= \frac{1}{2}(157 - 64·36)^2 = 4291·08$$

Step 6: $\frac{\partial z}{\partial m_1} = -(y_i - m_2 x_i^2 - m_1 x_i - c) x_i$

$$= -[157 - (1)(7·6)^2 - (7·6) + 1] 7·6$$

$$\frac{\partial z}{\partial m_1} = -704·06$$

$$\frac{\partial z}{\partial m_2} = -(y_i - m_2 x_i^2 - m_1 x_i - c) x_i^2$$

$$= -[157 - (1)(7·6)^2 - (1)(7·6) + (1)](7·6)^2$$

$$\frac{\partial z}{\partial m_2} = -5350·88$$

$$\frac{\partial z}{\partial c} = -(y_i - m_2 x_i^2 - m_1 x_i - c)$$

$$= -[157 - (1)(7·6)^2 - (1)(7·6) + c)]$$

$$\frac{\partial z}{\partial c} = -92·64$$

$$\text{step-7:} \quad \Delta m_1 2 = -n \frac{\partial E}{\partial m_1} = -(0.1)(-7004.06)$$

$$= 70.4$$

$$\Delta m_2 = -n \frac{\partial E}{\partial m_2} = -(0.1)(-5330.88)$$

$$= 535.08$$

$$\Delta c = -n \frac{\partial E}{\partial c} = -(0.1)(-92.64) = 9.26$$

step-8:- $m_1 = m_1 + \Delta m_1 = 1 + 70.4 = 71.4$

$m_2 = m_2 + \Delta m_2 = 1 + 535.08 = 536.08$

$c = c + \Delta c = -1 + 9.26 = 8.26$

step-9: Sample $\Rightarrow$ $i = i+1 = 1+1 = 2$ & $i \leq n$, To step ④

step-4 $y_p^i = m_2 (x_i)^2 + m_1 x_i + c$

$$= 536.08 (7.1)^2 + (71.4)(7.1) + 8.26$$

$$= 27023.79 + 506.94 + 8.26$$

$$y_p^i = 27538.99$$

step-5: $E = \frac{1}{2}(y - y_p^p) = \frac{1}{2}(174 - 27538.99)^2$

$$E = 374421338.9$$

step-6:- $\frac{\partial E}{\partial m_1} = -[y_i - m_2 x_i^2 - m_1 x_i - c] x_i$

$$= -[174 - (536.08)(7.1)^2 - (71.4)(7.1) - 8.20](7.1)$$

$$= -(174 - 27023.79 - 506.94 - 8.26)(7.1)$$

$$= -(-27364.99)(7.1)$$

$\frac{\partial E}{\partial m_1} = 194291.229$

$\frac{\partial E}{\partial m_2} = -[y_i - m_2 x_i^2 - m_1 x_i - c] x_i^2$

$$= -(-7364.99$$

$\frac{\partial E}{\partial} = 27364.99$

Step-7 :
$$\delta m_1 = -n\frac{\partial z}{\partial m_1} = -(0.1)(194291.429)$$
$$= -19429.14$$
$$\delta m_2 = -n\frac{\partial z}{\partial m_2} = -(0.1)(137926.91a)$$
$$= -13792 6.91$$
$$\delta c = -n\frac{\partial z}{\partial c} = -(0.1)(27364.99)$$
$$= -2736.49$$

Step-8
$$m_1 = m_1 + \delta m_1 = 71.4 - 19429.114$$
$$= -19357.74$$
$$m_2 = m_2 + \delta m_2 = 536.08 - 137926.91$$
$$= -137410.83$$
$$c = c + \delta c = 8.26 - 2736.49$$
$$= -2728.13$$

Step-9 sample $i = i+1 = 2+1 = 3$ & $i \le n_s$ $7 \to$ next step

Step-10 : iter $=$ iter$+1 = 1+1 = 2$, iter $>$ epochs
$7 \to$ next step

Step-11: End.